ISSN 2336-3193
DOI: 10.2478/cszma-2019-0020

Acta Mus. Siles. Sci. Natur., 68: 195-199, 2019
Published: online 1 December 2019, print December 2019

New distribution records of *Solidago ×niederederi* (Asteraceae) in Austria, Italy, and Poland

Artur Pliszko, Wojciech Adamowski & Konrad Pagitz

New distribution records of *Solidago ×niederederi* (Asteraceae) in Austria, Italy, and Poland. – Acta Mus. Siles. Sci. Natur., 68: 195-199, 2019.

Abstract: The paper presents a list of 23 new records of *Solidago ×niederederi*, a spontaneous hybrid between the North American *S. canadensis* and the European *S. virgaurea*. The list includes 8 records from Austria, 3 records from Italy and 12 records from Poland. An increase in the number of hybrid localities over the last 10 years in Europe is pointed out and discussed.

Key words: alien species, biological recording, geographical distribution, plant hybridization, *Solidago*.

Introduction

Solidago ×niederederi Khek (Asteraceae), a natural hybrid between *S. canadensis* L. and *S. virgaurea* L., was described from Austria at the beginning of the 20th century (Khek 1905, Pliszko 2015). The parentage of the hybrid was confirmed by morphological, molecular, and phytochemical methods (Gudžinskas & Žalneravičius 2016, Karpavičienė & Radušienė 2016, Pliszko & Zalewska-Gałosz 2016, Radušienė *et al*. 2018). The hybrid is associated with *S. canadensis* and *S. virgaurea* and occurs in anthropogenic habitats such as abandoned fields, roadsides, railway embankments, disused quarries, and tree plantations (Nilsson 1976, Stace *et al*. 2015, Pliszko & Zając 2016, Pliszko *et al*. 2017, Reshetnikova 2019). Following Pyšek *et al*. (2004), *S. ×niederederi* should be treated as alien species in Europe because its parental species have different geographical origin. *Solidago canadensis* is native to North America whereas *S. virgaurea* s. str. is native to Europe (Pliszko 2013 and literature cited therein). The presence of the hybrid has been well documented in Austria, Italy, the United Kingdom, Denmark, Sweden, Norway, Germany, Poland, Lithuania, Latvia, and Russia (Nilsson 1976, Burton 1980, Sunding 1989, Pliszko 2013, Stace *et al*. 2015, Gudžinskas & Petrulaitis 2016, Pagitz 2016, Pliszko & Zalewska-Gałosz 2016, Jaźwa *et al*. 2018, Reshetnikova 2019, Vinogradova & Galkina 2019 and literature cited therein). However, it is still insufficiently recognized, considering the wide ranges of *S. canadensis* and *S. virgaurea* in Europe (Greuter 2006-2018) where the hybridization between these two species is possible to happen.

Solidago ×niederederi is a perennial plant possessing intermediate morphology between *S. canadensis* and *S. virgaurea* (Nilsson 1976, Pliszko 2013, Gudžinskas & Žalneravičius 2016, Karpavičienė & Radušienė 2016). It belongs to *Solidago* sect. *Solidago* nothosubsect. *Triplidago* Gudžinskas & Žalneravičius which is characterized by the formation of pseudo-rosettes on the tops of vegetative shoots (Gudžinskas & Žalneravičius 2016). It is able to spread by wind-dispersed fruits; however, the production of seeds in the hybrid is limited due to its reduced pollen viability (Migdałek *et al*. 2014, Karpavičienė & Radušienė 2016). The seeds of the hybrid show a high percentage of germination and they do not need cold stratification to break their dormancy (Pliszko & Kostrakiewicz-Gierałt 2017, 2018a). The successive naturalization of *S. ×niederederi* in anthropogenic habitats has been recently observed in Austria, Poland, Lithuania, Latvia, and Russia (Gudžinskas & Petrulaitis 2016, Pagitz 2016, Pliszko *et al*. 2017, Pliszko & Kostrakiewicz-Gierałt 2017, Jaźwa *et al*. 2018, Vinogradova &

Galkina 2019). Interestingly, using a Maxent model, a high probability of the hybrid occurrence (>0.6) was predicted in the territories of Austria, Belarus, the Czech Republic, Germany, Hungary, Italy, Lithuania, Poland, Russia (Kaliningrad Oblast), Slovenia, Slovakia, and Ukraine (Jaźwa *et al*. 2018). Furthermore, it is suggested that the hybrid can pose a threat to native *S. virgaurea* by competition for pollinators and introgressive hybridization (Pagitz 2016, Pliszko & Kostrakiewicz-Gierałt 2018b). In this paper, new distribution records of *S.* ×*niederederi* in Austria, Italy, and Poland are presented.

Materials and methods

Solidago ×*niederederi* was identified using morphological characters provided by Nilsson (1976) and Gudžinskas & Žalneravičius (2016). Field surveys were conducted in 2010-2018 in Austria and Italy and in 2018 in Poland. The list of new distribution records of the hybrid is ordered alphabetically by the names of the countries and includes (1) the name of administrative/physiographic area, (2) the name of locality (with GPS coordinates and altitude), (3) the type of habitat, (4) the date of collection/observation, (5) the name of collector/observer, and (6) the acronym of the herbarium where the collected specimens are preserved. The names of administrative/physiographic areas and localities within the countries are also arranged in alphabetical order. The physiographic division of Poland followed Solon *et al*. (2018).

Results and discussion

The list contains 23 new records of *Solidago* ×*niederederi*, including 8 records from Austria, 3 records from Italy and 12 records from Poland. The locality in Eisacktal, South Tyrol, Italy, at 1080 m a.s.l., is the highest point of the hybrid occurrence, so far. The number of hybrid localities in Europe has significantly increased during the last 10 years (Pliszko 2013, Pagitz & Lechner-Pagitz 2015, Gudžinskas & Petrulaitis 2016, Pliszko *et al*. 2017, Jaźwa *et al*. 2018). This can be explained by the ongoing invasion of *S. canadensis* as well as by the increase in interest on the hybrid occurrence among researchers (Gudžinskas & Petrulaitis 2016, Karpavičienė & Radušienė 2016, Pliszko *et al*. 2017, Jaźwa *et al*. 2018, Vinogradova & Galkina 2019). In Poland, the first locality of the hybrid was found in 1957 (Pliszko 2013). The second locality was evidenced in 2011 (Pliszko 2013) and a total of 55 localities have been recorded up to 2017 (Pliszko *et al*. 2017). According to Preston & Pearman (2015), plant hybrids are usually overlooked during field studies due to close morphological resemblance to their parental species and a lack of identification manuals. For proper identification of *S.* ×*niederederi* we recommend morphological and anatomical features given by Nilsson (1976), Gudžinskas & Žalneravičius (2016) and Karpavičienė & Radušienė (2016). Moreover, we would like to encourage researchers to verify the presence of the hybrid in countries in which a high probability of its occurrence has been predicted by Jaźwa *et al*. (2018).

LIST OF NEW RECORDS OF *SOLIDAGO* ×*NIEDEREDERI* IN AUSTRIA, ITALY, AND POLAND

Explanations of abbreviations: *obs*. – observer, BSG – herbarium of the Białowieża Geobotanical Station of the University of Warsaw, IB – herbarium of the Institute of Botany of the University of Innsbruck, KRA – herbarium of the Institute of Botany of the Jagiellonian University.

AUSTRIA

Carinthia

Sachsenburg, south of Feistritz (GPS: 46°48'55.65"N, 13°20'42.98"E; altitude: 625 m), along forest tracks, clearing, reforestations, 6 Aug 2016, *leg*. Konrad Pagitz, IB 72242.

Techelsberg a.W., northwest of Greilitz (GPS: 46°38'32.14"N, 14°4'5.08"E; altitude: 655 m), forest edge, 16 Jun 2010, *obs*. Konrad Pagitz.

Villach towards Bad Bleiberg, east of Mittewald ob Villach (GPS: 46°37'47"N, 13°47'19"E; altitude: 650 m), forest track, clearing, 21 Sep 2013, *obs*. Konrad Pagitz.

East Tyrol

Nikolsdorf towards Lengberg (GPS: 46°47'32.9"N, 12°53'59"E; altitude: 670 m), along forest tracks, forest edge, 18 Jul 2017, *leg*. Konrad Pagitz, IB 95232.

North Tyrol

Baumkirchen, Baumkirchnertal (GPS: 47°18'15.05"N, 11°33'21.7"E; altitude: 665 m), clearing, 27 July 2014, *obs*. Konrad Pagitz.

Kramsach west, north of Winkl, northwest of the chapel, (GPS: 47°26'41"N, 11°51'54"E; altitude: 595 m), along forest track, 11 Sep 2015, *obs*. Konrad Pagitz.

Mils towards Baumkirchen (GPS: 47°17'50,4"N, 11°32'23,2"E; altitude: 710 m), forest track, clearing, 26 Aug 2014, *obs*. Konrad Pagitz.

Telfs (GPS: 47°19'6.29"N, 11°6'3.80"E; altitude: 715 m), along the road to Seefeld, west of Sagl, 27 Jul 2018, *obs*. Konrad Pagitz, IB 95290.

ITALY

South Tyrol

Eisacktal, Freienfeld nearby Sterzing, Burg Reifenstein (GPS: 46°52'43.01"N, 11°26'36.69"E altitude: 960 m), rocky slope, shrubbery, 10 Sep 2015, *obs*. Konrad Pagitz & Caecilia Lechner Pagitz.

Eisacktal, Maria Trens, north of the church (GPS: 46°52'45"N, 11°29'12"E; altitude: 1080 m), along forest track, 26 Jun 2014, *obs*. Konrad Pagitz.

Pustertal, Vintl, Hinterdrittel, Klingenstein (GPS: 46°30"26.4"N, 13°54'03"E; altitude: 850 m), slope close to forest edge, 26 Aug 2011, *leg*. Konrad Pagitz, IB 42294.

POLAND

Lithuanian Lakeland, NE Poland

Garbas Pierwszy (54°08'38.2"N/22°37'04.1"E; altitude: 167 m), fallow land, 16 Aug 2018, *leg*. Artur Pliszko, KRA.

Przystajne (54°13'13.1"N/22°40'12.1"E; altitude: 206 m), fallow land, 15 Aug 2018, *leg*. Artur Pliszko, KRA.

Masurian Lakeland, NE Poland

Olecko (54°01'08.1"N/22°31'28.2"E; altitude: 172 m), fallow land, 13 Aug 2018, *leg*. A. Pliszko, KRA.

Northern Podlasie Plain, NE Poland

Białowieża-Podolany Drugie (52°41'13.46"N/23°51'20.84"E; altitude: *ca*. 163 m), fallow land, 22 Aug 2018, *obs.* Wojciech Adamowski.

Białowieża-Stoczek (52°42'37.94"N/23°51'56.36"E; altitude: *ca*. 175 m), fallow land, 24 Aug 2018, *obs.* Wojciech Adamowski.

Białowieża-Stoczek (52°42'23.58"N/23°51'15.37"E; altitude: *ca*. 180 m), fallow land, 18 Aug 2018, *obs.* Wojciech Adamowski.

Białowieża-Stoczek (52°41'53.08"N/23°52'18.03"E; altitude: *ca*. 155 m), unmown meadow, 22 Aug 2018, *obs.* Wojciech Adamowski.

Hajnówka-Paszki (52°44'42,61"N/23°33'18.47"; altitude: *ca*. 165 m), fallow land, 28 Aug 2018, *leg.* Wojciech Adamowski, BSG.

Narewka (52°50'01.72"N/23°46'40.94"E; altitude: *ca*. 155 m), fallow land, 28 Aug 2018, *leg.* Wojciech Adamowski, BSG.

Narewka (52°50'10.36"N/ 23°47'46.03"E; altitude: *ca*. 155 m), fallow land, 28 Aug 2018, *leg.* Wojciech Adamowski, BSG.

Pogorzelce (52°43'31.87"N/23°48'43.74"E; altitude: *ca*. 170 m), fallow land, 28 Aug 2018, *leg.* Wojciech Adamowski, BSG.

Przedbórz Upland, South-Central Poland

Opoczno (51°21'43.5"N/20°13'43.2"E; altitude: 192 m), fallow land, 08 Sep 2018, *leg*. Artur Pliszko, KRA.

Acknowledgments: Field studies made by the first author in Poland were financially supported by the Institute of Botany of the Jagiellonian University in Kraków (K/ZDS/007344).

References

Burton R. (1980): *Solidago* ×*niederederi* Khek in Britain. – Watsonia 13: 123-124.

Greuter W. (2006-2018): Compositae (pro parte majore). In: Greuter W. & Raab-Straube E. von (eds): Compositae. Euro+Med Plantbase – the information resource for Euro-Mediterranean plant diversity. Available from: http://ww2.bgbm.org [accessed on 11 October 2018]

Gudžinskas Z. & Petrulaitis L. (2016): New alien plant species recorded in the southern regions of Latvia. – Bot. Lith. 22: 153-160.

Gudžinskas Z. & Žalneravičius E. (2016): *Solidago* ×*snarskisii* nothosp. nov. (Asteraceae) from Lithuania and its position in the infrageneric classification of the genus. – Phytotaxa 253: 147-155.

Jaźwa M., Jędrzejczak E., Klichowska E. & Pliszko A. (2018): Predicting the potential distribution area of *Solidago* ×*niederederi* (Asteraceae). – Turk. J. Bot. 42(1): 51-56.

Karpavičienė B. & Radušienė J. (2016): Morphological and anatomical characterization of *Solidago* ×*niederederi* and other sympatric *Solidago* species. – Weed Sci. 64: 61-70.

Khek E. (1905): Floristisches aus Ober-Oesterreich. – Allg. Bot. Z. Syst. 11: 21-23.

Migdałek G., Kolczyk J., Pliszko A., Kościńska-Pająk M. & Słomka A. (2014): Reduced pollen viability and achene development in *Solidago* ×*niederederi* Khek from Poland. – Acta Soc. Bot. Pol. 83: 251-255.

Nilsson A. (1976): Spontana gullrishybrider (*Solidago canadensis* × *virgaurea*) i Sverige och Danmark. – Svensk Bot. Tidskr. 70: 7-16.

Pagitz K. (2016): *Solidago* ×*niederederi* (*S. canadensis* × *S. virgaurea* ssp. *virgaurea*) in the Eastern Alps. pp. 194. In: Ries C. & Krippel Y. (eds): Biological invasions: interactions with environmental change. Book of abstracts. NEOBIOTA 2016 – 9th International Conference on Biological Invasions. Vianden, Luxembourg.

Pagitz K. & Lechner-Pagitz C. (2015): Neues zur Neophytenflora Nord- und Osttirols (Österreich). – Neilreichia 7: 29-44.

Pliszko A. (2013): A new locality of *Solidago* × *niederederi* Khek (Asteraceae) in Poland. – Biodiv. Res. Conserv. 29: 57-62.

– (2015): Neotypification of *Solidago* ×*niederederi* (Asteraceae). – Phytotaxa 230: 297-298.

Pliszko A. & Kostrakiewicz-Gierałt K. (2017): Resolving the naturalization strategy of *Solidago* ×*niederederi* (Asteraceae) by the production of generative ramets and seedlings. – Plant Ecol. 218: 1243-1253.

– (2018a): Effect of cold stratification on seed germination in *Solidago* ×*niederederi* (Asteraceae) and its parental species. – Biologia 73(10): 945-950.

– (2018b): Flower-visiting insects on *Solidago* ×*niederederi* (Asteraceae): an observation from a domestic garden. – Botanica 24(2): 162-171.

Pliszko A., Łazarski G., Kalinowski P., Adamowski W., Rutkowski L. & Puchałka R. (2017): An updated distribution of *Solidago* ×*niederederi* (Asteraceae) in Poland. – Acta Mus. Siles. Sci. Natur. 66: 253-258.

Pliszko A., Zając M. (2016): Current and potential distribution of *Solidago* ×*niederederi* (Asteraceae) in Poland. pp. 163. In: Ries C. & Krippel Y. (eds): Biological invasions: interactions with environmental change. Book of abstracts. NEOBIOTA 2016 – 9th International Conference on Biological Invasions. Vianden, Luxembourg.

Pliszko A. & Zalewska-Gałosz J. (2016): Molecular evidence for hybridization between invasive *Solidago canadensis* and native *S. virgaurea*. – Biol. Invasions 18: 3103-3108.

Preston C.D. & Pearman D.A. (2015): Plant hybrids in the wild: evidence from biological recording. – Biol. J. Linn. Soc. 115: 555-572.

Pyšek P., Richardson D.M., Rejmánek M., Webster G.L., Williamson M. & Kirschner J. (2004): Alien plants in checklists and floras: towards better communication between taxonomists and ecologists. – Taxon 53: 131-143.

Radušienė J., Marksa M. & Karpavičienė B. (2018): Assessment of *Solidago* ×*niederederi* origin based on the accumulation of phenolic compounds in plant raw materials. – Weed Sci. 66: 324-330.

Reshetnikova N.M. (2019): The new data on the flora of Smolensk Province (2017-2018). – Bull. Mosc. Soc. Natur. Biol. Ser. 124(3): 36-43.

Solon J., Borzyszkowski J., Bidłasik M., Richling A., Badora K., Balon J., Brzezińska-Wójcik T., Chabudziński Ł., Dobrowolski R., Grzegorczyk I., Jodłowski M., Kistowski M., Kot R., Krąż P., Lechnio J., Macias A., Majchrowska A., Malinowska E., Migoń P., Myga-Piątek U., Nita J., Papińska E., Rodzik J., Strzyż M., Terpiłowski S. & Ziaja W. (2018): Physico-geographical mesoregions of Poland: verification and adjustment of boundaries on the basis of contemporary spatial data. – Geogr. Pol. 91(2): 143-170.

Stace C.A., Preston C.D. & Pearman D.A. (2015): Hybrid flora of the British Isles. Botanical Society of Britain and Ireland, Bristol, 501 pp.

Sunding P. (1989): Naturaliserte Solidago-(gullris-) arter i Norge. – Blyttia 47: 23-27.

Vinogradova Yu.K. & Galkina M.A. (2019): Hybridization as a factor of invasive activity of alien species of goldenrods (*Solidago*). – J. Gen. Biol. 80(1): 43-56.

Authors' addresses: Artur Pliszko, Department of Taxonomy, Phytogeography, and Palaeobotany, Institute of Botany, Jagiellonian University in Kraków, Gronostajowa 3, 30-387 Kraków, Poland. E-mail: artur.pliszko@uj.edu.pl (corresponding author)

Wojciech Adamowski, Białowieża Geobotanical Station, Faculty of Biology, University of Warsaw, Sportowa 19, 17-230 Białowieża, Poland; E-mail: w.adamowski@uw.edu.pl

Konrad Pagitz, Institute of Botany, University of Innsbruck, Sternwartestraße 15, A-6020 Innsbruck, Austria; E-mail: Konrad.Pagitz@uibk.ac.at